SELF-REGULATED LEARNING AND ACADEMIC ACHIEVEMENT AMONG MEDICAL STUDENTS: AN ACCELERATED PROSPECTIVE COHORT STUDY

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Abstract

Objectives: To determine the relationships between the use of self-regulated learning strategies and academic achievement among Vietnamese medical students. **Methods:** An accelerated prospective cohort study among 623 students at a public medical university, Vietnam was conducted during the academic year 2012-2013. Fourteen self-regulated learning subscales including intrinsic/extrinsic goal orientation, task values, self-efficacy for learning, control of learning beliefs, rehearsal, elaboration, organization, critical thinking, meta-cognitive strategies, time and study environment, effort regulation, peer learning, and help seeking were measured using the Motivated Strategies for Learning Questionnaire. The Grade Point Average was recorded through two consecutive semesters of the academic year 2012-2013. Data were collected at two points in time (once each semester). Generalized Estimating Equation was applied to explore any relationships between the use of self-regulated learning subscales and Grade Point Average, adjusting for the effects of within cluster correlation, National Medical Admission Test scores, and times of measurement, depression, anxiety, stress, and demographic covariates. **Results:** Results from multivariate analysis revealed that extrinsic goal orientation, time and study environment, and effort regulation were found to be significantly positively associated with Grade Point Average (mean difference: 0.932; 95%CI: 0.344 to 1.528). **Conclusions:** The use of self-regulated learning strategies can be helpful for improving of academic achievement among Vietnamese medical students.

Key words: *self-regulated learning, academic achievement, medical students, Vietnam*

1. INTRODUCTION

Medical education is a developmental process toward medical professional life that demands self-regulated and life-long learning proficiencies [1][2][3][4][5]. Responding to these demands, the worldwide innovation in medical education, in the last two decades, has been shifting from teacher-centered to student-centered approaches [3][6]. This shifting has given rise to the concept of Self-Regulated Learning [2][6][7].

Self-Regulated Learning (SRL) is the application of general self-regulation theory to the field of education which focuses on students' ability of regulating their own learning strategies and learning motivation in order to optimize their achievement and satisfaction [8][9][10][11][12]. According to Pintrich, SRL is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviors, guided and constrained by their goals and the contextual features of environment" (Pintrich, 2010, pp 453). By possessing a high level of cognitive and meta-cognitive strategies, learning motivation and resources management, SRL learners tend to surpass their counterparts in improving their academic achievement [12][13] and clinical competency [14] [15]. In addition, they are also better in coping with learning difficulties or failures that, consequently, may improve their academic achievement [16][17] [18][19], and mental health[20]. However, recent SRL studies mostly focus on the field of general education whereas medical education as a distinctive field of education has been largely neglected [6].

In Vietnam, the innovation in medical education toward student-centered approaches has been a priority policy of the Ministry of Education & Training and Ministry of Health for more than ten years aims at improving students' academic achievement and independent lifelong learning proficiency [21]. However, student's passivity in learning is still a big challenge for medical schools [22]. Although, much attention have been paid in attempting to improve students' SRL capacity; however, the application of SRL and its relation to their academic achievement

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has not been studied. This study, therefore, aims at determining the relationships between the use of SRL strategies and academic achievement among Vietnamese medical students. Findings can be helpful for instructors and students to gain understanding of their own teaching and learning strategies and thus help them to seek additional effort and actions to improve it.

2. METHOD

Design and ethical approval

To answer the research question and improve the weaknesses of the previous study design, an accelerated prospective cohort study and repeated measurement was applied to this study. The current training curriculum for general practitioners (GP) in Vietnam is a six years course in which the first three years focuses on the basic medical sciences and the remaining three years focuses on the clinical subjects. Although, there are six parallel academic year, however, the students of year sixth were about to graduate at the time of the study was carried out. Therefore, they were not invited to join the study.

Obviously, each academic year is a distinctive cohort in terms of curriculum, content to be learned as well as instructors. It is also highly assumed that the use of SRL strategies also varies depending on academic year and training periods. To tackle this complexity, ideally, a five years longitudinal design and repeated measurement should be applied since students attend the college until year five. However, this design seems to be costly in terms of time and effort. An alternative design for this complexity is application of an accelerated prospective cohort study with repeated measurement. The accelerated prospective cohort design based on the assumption that a pooled cohort consisting of sub-cohorts representing for students from each batch is followed up in one academic year. As such the time of follow up can be shortened to one year while the magnitude of effect can be generalized to students of all five years using data from one year of follow up.

The proposal and tools of this study were reviewed and approved by the Ethics Committee for Human Research of Khon Kaen University, Thailand. Before collecting data, the Explanation and Informed Consent forms were sent to the participants. Those who agree to join the study need to sign the Informed Consent form and return it to the research team. Names of participants were recoded as numbers to protect students' anonymity.

Participants

A stratified random sample of 776 general practitioner students representing for five academic years were invited to join the study. The sixth year students were not invited to join because they were about graduated at the time of conducting this study. To recruit the required study sample, firstly we stratified students by year then by class in which they were belonging to. The simple random sampling procedure was applied to each class to obtain the required sample size.

Instruments

To measure the students' use of SRL strategies, we used the Motivated Strategies for Learning Questionnaire (MSLQ) [23]. The MSLQ is a self-report instrument for measuring students' learning motivation and learning strategies in undergraduates which was developed by Pintrich, Smith, Garcia, and McKeachie (1991). The written permission to use of this instrument was given by University of Michigan, USA. The MSLQ comprises of two subscales including learning motivation and learning strategies [23]. The motivational scales consist of 26 items measuring five dimensions of learning motivation including self-efficacy for learning, intrinsic/extrinsic goal orientations, task value and control of learning beliefs. The learning strategies subscales consist of 50 items measuring cognitive strategies (19 items), meta-cognition (12 items) and resources management (19 items). Each item is responded on a 7 Likert scale ranging from "not all true of me" (1) to "very true of me" (7). The MSLQ was tested for reliability on a small sample of students before use. The Cronbach's alphas of the MSLQ subscales were above 0.70 indicating that they were internally consistent. There were two MSLQ subscales which had extremely low Cronbach's alphas including help seeking (α=0.51) and effort regulation (α=0.54), however, they were consistent with those of the original version [23].

For students' academic achievement, the Grade Point Average (GPA) was recorded through two consecutive semesters of the academic year 2012-2013. In addition, we used the Depression Anxiety and Stress Scales 21 items (DASS-21) [24] to measure psychological distress, and a demographic questionnaire developed by researchers was used to measure demographic variables.

Measurement

A battery consisting of MSLQ, DASS-21 and academic and demographic questionnaire was administrated to the participants in classroom after the lecture session and took them about 30 minutes to complete. There were two times of data collection during academic year 2012-2013. The first time was

carried out in the first semester and the second was in the second semester.

Statistical analysis

The STATA version 10.0 (StataCorp, 2007) was used to analyze data. Mean and standard deviation (SD) were used to summarize the continuous data, percentage (%) and frequency for the categorical data. To identify the magnitude of effect of SRL subscales on students' academic achievement, we applied Generalized Estimating Equation (GEE). The following quantities were used to build the GEE model. Type of model: population average (PA-GEE), cluster identification (i): students' class, Link function: Identity, Correlation structure: Exchangeable and time variables (t): times of measurement[25]. Because SRL subscales were highly intercorrelated to each others which might lead to multicolinearity problem and underestimation, therefore, we applied GEE analysis in two stages. Firstly, we used multivariate GEE analysis to identify any relationships between the use of each SRL subscale on GPA adjusting for effect of sex, National Medical College Admission Test scores (NMCAT), psychological distress (depression anxiety and stress scores), and other demographic covariates (separate multivariate model). Second, we included all SRL subscales and demographic covariates into the multivariate GEE model to estimate the total effect of SRL on GPA adjusting for the effect of sex, age, NMCAT, psychological distress and other demographic covariates. The QIC test (quasilikelihood under the independent model criterion) and standard error of the estimators were used to fit the multivariate GEE model. The best fitted multivariate GEE model was the one which had smallest QIC value and standard errors of the estimators [25][26].

The results were reported showing mean different (average GPA score changed given one score change in SRL subscales), 95% CI, and p value.

3. RESULTS

Descriptive statistics

At the first time of data collection, there were 744 participants jointed study (response rate of 95.44%) and 623 at time two (drop-out rate of 16.26%). Among 623 participants followed to the end of the study, 342 of them (54.89%) were male, their age ranged from 18 to 27 years (mean 20.92, SD=1.5). Four students (0.64%) reported belonging to the minority group. GPA ranged from 3.76 to 9.12 with mean of 7.56 (SD=0.75). Further demographic characteristics of the study sample were showed in the Table 1. The descriptive statistics of SRL were presented in the Table 2.

Table 1. Demographic characteristics of the study sample (n=623)

Characteristics	Time 1		Time 2	
	n	%	n	%
Age (mean, SD)	623	20.92 ± 1.5	623	20.92±1.5
NMCAT (mean, SD)	623	23.81 ± 2.06	623	23.81±2.06
Year of study				
Year 1	141	22.63	141	22.63
Year 2	145	23.27	145	23.27
Year 3	126	18.62	126	18.62
Year 4	120	19.26	120	19.26
Year 5	101	16.22	101	16.22
Sex				
Male	342	54.9	342	54.9
Female	281	45.1	281	45.1
Ethnic groups				
Minority	4	0.6	4	0.6
Majority (the Kinh)	619	99.4	619	99.4
Financial difficulty				
Yes	52	8.35	61	9.79
Part time job				
Yes	69	11.08	72	11.56
Computer possession				
Yes	548	87.96	514	82.50
Internet accessibility				
Yes	528	84.75	482	77.37

DASS-depression	623	4.28 ± 3.01	623	4.43 ± 3.28
DASS-anxiety	623	5.62 ± 3.17	623	5.31 ± 3.52
DASS-stress	623	7.03 ± 3.06	623	7.05 ± 3.48

Note: SD = Standard Deviation, NMCAT = National Medical College Admission Test scores.

Table 2. Descriptive statistics of SRL (n=623)

Subscales	Total items	Time 1 (Mean±SD)	Time 2 (Mean±SD)	Alpha	Alpha (Pintrich et al, 1991)
Motivational subscales					
Intrinsic goal orientation	4	4.82± 0.99	4.84 ± 1.03	0.68	0.74
Extrinsic goal orientation	4	4.29 ± 1.10	4.30 ± 1.09	0.68	0.62
Task value	6	4.88 ± 0.92	4.99 ± 0.94	0.78	0.90
Control of learning beliefs	4	5.71 ± 0.83	5.58 ± 1.06	0.64	0.68
Self-efficacy for learning	8	4.32 ± 0.96	4.47 ± 0.92	0.87	0.93
Cognitive and meta-cognitive subscales					
Rehearsal	4	4.54 ± 0.97	4.61 ± 0.92	0.64	0.69
Elaboration	6	4.70 ± 0.91	4.78 ± 0.97	0.81	0.76
Organization	4	4.68 ± 1.04	4.79 ± 1.07	0.72	0.64
Critical thinking	5	4.30 ± 0.98	4.44 ± 0.96	0.76	0.80
Meta-cognitive	12	4.62 ± 0.77	4.67 ± 0.82	0.81	0.79
Resources management subscales					
Time and study environment	8	4.43 ± 0.84	4.48 ± 0.85	0.69	0.76
Effort regulation	4	4.11 ± 1.08	4.17 ± 1.02	0.56	0.69
Peer learning	3	3.52 ± 1.13	3.89 ± 1.10	0.74	0.76
Help seeking	4	4.18 ± 0.96	4.09 ± 0.92	0.51	0.52

Note: DASS-21: Depression Anxiety and Stress Scales 21 items; SRL: Self-regulated learning; SD: standard deviation

The relationships between the use of SRL strategies and academic achievement

The separate multivariate analysis indicated that seven SRL subscales including extrinsic goal orientation, task values, self-efficacy for learning, rehearsal, organization, time and study environment, and effort regulation were found to be significantly positively associated with GPA, adjusting for the effects of sex, age, NMCAT, psychological distress and other demographic covariates (Table 3). Whereas, full multivariate GEE analysis has shown that extrinsic goal orientation, time and study environment and effort regulation were found to be significantly positively associated with GPA adjusting for the effects of NMCAT, psychological distress and demographic confounding variables (Table 4).

Table 3. Separate multivariate GEE analysis for assessing effects of SRL subscales on GPA, adjusting for effect of within cluster correlation, time of measurement, NMCAT, and demographic covariates (n=623)

Variables	GPA scores			
	Mean dif.	95%CI		p-value
Motivation				
Intrinsic goal orientation	0.01	- 0.028	0.047	0.628
Extrinsic goal orientation	0.067	0.031	0.10	< 0.001
Task values	0.048	0.006	0.09	0.025
Control of learning beliefs	0.001	- 0.039	0.04	0.973
Self-efficacy for learning	0.085	0.043	0.126	< 0.001
Cognitive and meta-cognitive strategies				
Rehearsal	0.048	0.01	0.087	0.017
Elaboration	0.028	- 0.013	0.069	0.187
Organization	0.052	0.015	0.089	0.006

Critical thinking	0.006	- 0.034	0.046	0.775
Meta-cognition	0.039	- 0.01	0.087	0.123
Resources management				
Time and study environment	0.141	0.095	0.188	< 0.001
Effort regulation	0.099	0.062	0.136	< 0.001
Peer learning	0.022	- 0.012	0.055	0.208
Help seeking	- 0.008	- 0.049	0.032	0.686

Notes: Mean dif.=mean difference; GEE=generalized estimating equation, GPA=grade point average.

Table 4. Full multivariate GEE analysis for assessing effects of SRL subscales on GPA, adjusting for effect of within cluster correlation, time of measurement and demographic covariates (n=623)

Variables	GPA scores		
	Mean dif.	95%CI	p-value
Exposure of interest			
Motivational subscales			
Intrinsic goal orientation	-0.014	-0.066 0.038	0.603
Extrinsic goal orientation	**0.052**	**0.015 0.090**	**0.006**
Task values	0.010	-0.049 0.069	0.736
Control of learning beliefs	-0.015	-0.062 0.032	0.527
Self-efficacy for learning	0.050	-0.006 0.106	0.082
Cognitive and meta-cognitive subscales			
Rehearsal	-0.009	-0.063 0.045	0.744
Elaboration	-0.018	-0.091 0.056	0.641
Organization	0.030	-0.025 0.086	0.282
Critical thinking	-0.033	-0.095 0.028	0.286
Meta-cognition	-0.045	-0.130 0.040	0.297
Resources management subscales			
Time and study environment	**0.124**	**0.059 0.189**	**< 0.001**
Effort regulation	**0.057**	**0.012 0.103**	**0.014**
Peer learning	-0.003	-0.045 0.038	0.874
Help seeking	-0.025	-0.071 0.021	0.290
Confounding variables			
NMCAT	**0.097**	**0.074 0.20**	**< 0.001**
Age	-0.045	-0.100 0.010	0.107
Male	**-0.319**	**-0.398 -0.240**	**< 0.001**
Ethics (minority)	-0.159	-0.621 0.303	0.500
No internet accessibility	**-0.236**	**-0.352 -0.120**	**< 0.001**
Having computer for learning	**0.165**	**0.032 0.298**	**0.015**
Financial difficulty	-0.037	-0.166 0.093	0.579
Having part-time job	-0.053	-0.169 0.064	0.376

Notes: Mean dif.=mean difference; GEE=generalized estimating equation, GPA=grade point average.

4. DISCUSSION

The purpose of this study was to identify the relationships between the use of SRL strategies and academic achievement among Vietnamese medical students. Findings highly supported our hypothesis that increasing use of SRL strategies could help improving academic achievement among Vietnamese medical students. The magnitude of observed

effect was considered to be large and clinically significant. For example, students who reported using moderate level of SRL strategies (score of 4 for each subscale) tended to achieve 0.932 higher scores for GPA (95%CI: 0.344 to 1.528) adjusting for the effects of NMCAT, psychological distress and demographic covariates in comparison to those who do not use. These findings were consistent with those of previous studies; however, it rather varied depending on the context of study. For instance, Artino (2012) found that avoidance help seeking was negatively associated with GPA among US medical students [27]; Turan & Demirel (2010) found that the successful students were observed more often using SRL strategies as compared to the unsuccessful students [28]. Similarly, Hosain et al (2012); Sansgriry et al (2004) found that time management and study strategies were significantly associated with GPA among US pharmaceutical students [29][30]; Kosnin (2007) conducted a survey in 460 second year medical students and found that all SRL subscales were statistically higher in the group of high achiever students in comparison to those in lower achiever ones, however only meta-cognition, resources management and self-efficacy for learning were found to be statistically significant predictors of GPA in multiple regression model [31]. These differences might reflect the Pintrich's assumption that the effect of SRL strategies on students' academic achievement is highly contextual dependent [12][32][34].

Regarding the magnitude of effect, the full multivariate GEE model indicated that three SRL subscales including extrinsic goal orientation, time and study environment and effort regulation were found to be significantly positively associated with GPA. The magnitude of effect is considered to be large and clinically significant. For example, if students applied moderate level of SRL strategies (score of 4) to their learning process they are likely to achieve total 0.932 higher score for GPA (95%CI: 0.344 to 1.528) as compared to those who do not apply those strategies. However, this magnitude of effect might be underestimated due to the multicolinearity problem. According to Zidek, Wong, Le, and Burnett (1996) high multicolinearity among explanatory variables could result in underestimation problem in a predictive multivariate model [35]. Data from our study indicated that SRL subscales were highly intercorrelated to each others (r ranges up to 0.76) therefore the multicolliearity could be occurred and might caused underestimation problem in full multivariate model. To handle this problem we included separately each SRL subscale into the multivariate model for estimating its effect on GPA adjusting for the effects of NMCAT, psychological distress, and other demographic covariates (separate multivariate model). Results have shown that 7 out of 14 SRL subscales were found to be significantly positively associated with students' GPA after adjusting for the effects of NMCAT, psychological distress, and other demographic covariate. This magnitude of effect seems to be very large and clinically significant. For instance, if students applied moderate level of SRL strategies (score of 4) to their learning process they are likely to achieve total 2.16 higher scores for GPA (95%CI: 1.048 to 3.264) in comparison to those who do not apply.

Although the significant relationships between the use of SRL strategies and students' academic achievement were observed, however, several limitations of this study should also be considered to provide appropriate orientations for the future studies. First of all this study involved students who followed a traditional curriculum therefore findings might not be generalized to those in a more student-centered curriculum such as problem-based learning. There are evidences suggesting that students in a problem-based curriculum might be more appropriately and frequently applying SRL strategies than those in a traditional curriculum [7][36][37]. For this reason, the effect of using SRL strategies on GPA could be optimized. We suggest that future study involving participants from a student-centered curriculum such as problem-based learning is necessary to provide further evidences for this research area. Secondly, the self-report instrument such as MSLQ also has its own limitation. It focuses on measuring students' general perception on their application of SRL strategies but it is less useful for measuring SRL as the actual events [32][38]. In addition, the subscales of the MSLQ were highly intercorrelated and some of them such as help seeking and effort regulation had extremely low reliability. These limitations might cause multicollinearity problem and resulting in underestimation in the predictive model. According to Winne&Perry (2010), depending on the target measurement the alternative protocol of measurement should be used [38]. To measure SRL as event, the observation protocol should be applied. We suggest that future study should apply the mixed design which involves self-report instrument and observation protocol measurement to draw valid interpretation on the relationships between the use of SRL strategies and academic achievement among medical students.

5. CONCLUSION

Findings highly supported our hypothesis that using SRL strategies could help improving academic achievement among Vietnamese medical students. The magnitude of effect was considered to be large and clinically significant. From these findings, we suggest that the innovation of teaching and learning in medical education should take SRL perspectives into account in order to help improving students' academic achievement.

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